MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS

2023/2024 ACADEMIC YEAR

FOURTH YEAR FIRST SEMESTER

SCHOOL OF BUSINESS AND ECONOMICS.

DEGREE IN ECONOMICS AND STATISTICS.

COURSE CODE: ECS 4108-1

COURSE TITLE: APPLIED MULTIVARIATE.

DATE: ,DEC,2023 **TIME:**

INSTRUCTIONS TO CANDIDATES

Answer Question ONE and any other TWO questions

This paper consists of FOUR printed pages. Please turn over.

Question One

a. State any two properties of orthogonal matrix. Hence show that;

$A = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ is orthogonal **(2 marks)**

b. Give two properties of canonical correlation **(2 marks)**

c. Let $A = \begin{pmatrix} 3 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{pmatrix}$, find;

i. The eigenvalues of A **(6 marks)**

ii. Tr(A) **(2 marks)**

iii. Determinant of A **(2 marks)**

d. In discriminant analysis, group represent either a population or a sample. Explain two main objectives to be considered in separation of groups **(4 marks)**

e. State two properties of multivariate normal distribution **(2 marks)**

Question Two

a. Samples of steel produced at two different rolling temperatures are compared, where y1 is the yield point and y2 is the ultimate strength as shown in the table.

Temperature 1		**Temperature 2**	
y1	**y2**	**y1**	**y2**
33	60	35	57
36	61	36	59
35	64	38	59
38	63	39	61
40	65	41	63
		43	65
		41	59

Calculate;

i. The pooled covariance matrix (S_{pl}) **(8 marks)**

ii. The discriminant function **(5 marks)**

iii. The values of projected points **(2 marks)**

Question Three

a. Three variables are measured at 10 different locations and the data is recorded as shown.

Location No.	y1	y2	y3
1	35	3.5	2.80
2	35	4.9	2.70
3	40	30.0	4.38
4	10	2.8	3.21
5	6	2.7	2.73
6	20	2.8	2.81
7	35	4.6	2.88
8	35	10.9	2.90
9	35	8.0	3.28
10	30	1.6	3.20

Given the covariance matrix $S = \begin{pmatrix} 140.54 & 49.68 & 1.94 \\ 49.68 & 72.25 & 3.68 \\ 1.94 & 3.68 & 0.25 \end{pmatrix}$, find

i. Correlation matrix, R **(3 marks)**

ii. Given that $z = 3y1 - 2y2 + 4y3$, find mean and variance of z **(4 marks)**

iii. Another linear combination $w = y1 + 3y2 - y3$. Find the sample correlation between z and w **(3 marks)**

iv. Given the following three linear functions. Calculate correlation matrix R_Z **(5 marks)**

$z1 = y1 + y2 + y3$

$z2 = 2y1 - 3y2 + 2y3$

$z3 = -y1 - 2y2 - 3y3$

Question Four

a. Explain three properties of the two sample T^2 test **(3 marks)**

b. In a classical experiment, eight orange trees from each of the six rootstocks were compared. The experiment investigated the comparison using four variables (extension growth, weight above ground, diameter, trunk girth). The four eigen values of $E^{-1}H$ are 1.886, 0.792, 0.239, and 0.026. Test the hypothesis $H_0: \mu_1 = \cdots = \mu_6$ using

i. Approximated F statistic for Wilk's test **(4 marks)**

ii. Lawley-Hotelling statistic **(3 marks)**

c. Using the data in question (3a), by applying the Hotelling T^2 test. Test the hypothesis that: $H_0: \mu = \begin{pmatrix} 27.8 \\ 6.6 \\ 3.0 \end{pmatrix}$. Use $\alpha = 0.05$ **(5 marks)**